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DDT RESIDUE ACCUMULATION AND DECLINE IN KIDNEY FAT OF LAMBS GRAZING SPRAYED FOREST RANGE

by

Gerald S. Strickler, *Plant Ecologist*

ABSTRACT

DDT residues in fat of weaner lambs grazing 1, 2, 6, 10, and 14 weeks (five treatment groups) in forests sprayed with DDT for Douglas-fir tussock moth control increased rapidly up to 2 weeks, then decreased. Following removal of lambs to unsprayed feed for 14 to 22 weeks, fat residue levels declined, but only those in the 1- and 2-week treatments fell significantly below the 5-p/m tolerance level.

KEYWORDS: DDT residue, DDT monitoring, DDT in sheep.

REST SERVICE - U.S. DEPARTMENT OF AGRICULTURE - PORTLAND, OREGON

INTRODUCTION

As part of the monitoring program of the 1974 Douglas-fir Tussock Moth Project,[1] a study was made of DDT residues in kidney fat, muscle tissue, rumen, and feces of lambs grazing a forested range aerially sprayed with approximately 0.75 pound of DDT per acre.

Much interest in the study results has been generated by ranchers and agricultural organizations concerning the buildup and decline of DDT residue in the lambs relative to the 5-p/m tolerance level[2] in fat of marketable livestock. Analyses of the fat samples have been completed and are reported here. This should be considered a preliminary report; a complete report of residues in vegetation and all lamb tissue samples will be made following completion of the analyses.

METHODS

Spraying on the allotment was completed on June 24. On June 26, 120 weaned lambs, approximately 5 months old and 70 pounds in weight, were trucked to the allotment, ear tagged, and separated into six groups of 20 lambs each. Within groups, lambs were randomly assigned to one of six, three-lamb lots for tissue sampling. Two lambs per group were designated as replacements if needed.

The control group (C) was immediately trucked to an unsprayed allotment, placed with a 1,800-head ewe-lamb band, and the first three-lamb lot slaughtered at this time for tissue samples. The nearest spraying of DDT was 6 air miles from areas grazed on the unsprayed allotment; therefore the likelihood of DDT contamination of forage utilized by the ewe-lamb band was zero. This was later verified by residue analysis of vegetation samples.

The remaining five groups began grazing the DDT-sprayed allotment. These groups (treatment groups) are identified by the numbers 1, 2, 6, 10, and 14, corresponding to the number of weeks a group grazed the DDT-sprayed forage. After grazing the designated time, a group was corralled, 3 animals sacrificed, tissue samples taken, and the remaining 17 lambs trucked to the unsprayed allotment. Three animals were sacrificed and tissue samples taken from the control group when each treatment group was placed on the unsprayed allotment.

Once on the unsprayed allotment, the five sample lots remaining in each treatment group were sequentially slaughtered at various times during a 22-week period. Time of sampling lots varied for each group due to the feasibility and efficiency of gathering the lambs relative to the location and movement of the ewe-lamb band. Number of lambs available for each treatment varied between 17 and 20 because of death, lost sheep, and the use of the two replacement lambs in groups 2, 6, and 10 as a final sample.

The grazing season on both allotments terminated 14 weeks after the study began. Lambs remaining at this time (October 1) were put on unsprayed wheat stubble for 6 weeks (until November 12) and then lot-fed alfalfa-orchardgrass hay until the last samples were taken on January 8.

Before each tissue sample was taken from a carcass, knives were

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[1] USDA-USDI Environmental Statement. Cooperative Douglas-fir Tussock Moth Pest Management Plan. Idaho-Oregon-Washington. U.S. Department of Agriculture, Forest Service. 301 p., mimeographed. December 1973.

[2] Federal Register, Vol. 39, No. 157, Tuesday, August 13, 1974. Rules and regulations, Part 180 - Tolerance and exemptions from tolerances for pesticide chemicals in or on raw agricultural commodities, p. 28977-28978.

cleaned and thoroughly rinsed with acetone. Disposable surgical gloves were also rinsed with acetone and disposed of after each tissue sampling. Care was taken not to contaminate samples through contact with surrounding tissue. Kidney fat samples were taken, after the viscera had been dropped, by pulling out the kidney and attached fat, severing it from the body cavity, and "peeling" the fat from the kidney.

Tissue samples were placed in acetone-rinsed cans, frozen, and shipped on dry ice to the laboratory. Samples were analyzed by gas chromatography using a modified Mills, Onley, Gaither procedure.[3/] Log transformation of residue values was used to yield more realistic means and confidence intervals. Differences in mean residue of DDT among the five treatment groups (control groups were not tested) when they were removed from the sprayed allotment were tested by analysis of variance using the logarithmic transformed values. Mean residues of lamb groups in the five treatments on the unsprayed allotment were tested with a one-tailed "t" test for those levels which were significantly less than 5-p/m tolerance level.

All residues reported are the sum of DDT (p,p' and o,p' isomers) and the metabolites, DDE and DDD, in parts per million on the total lipid basis.

[3/] Environmental Protection Agency. Manual of analytical methods. Section 5 A, (1) - Analysis of human or animal adipose tissue. Pesticide and Toxic Substances Effects Laboratories. National Environmental Research Center, Research Triangle Park, North Carolina. 1972.

RESULTS AND DISCUSSION

Low mean residues in the control kidney fat samples throughout the study showed not only that the lambs were relatively free of DDT when the study began but also there was no DDT contamination of forage on the unsprayed allotment during the 14-week season (table 1).

Mean residues in kidney fat for the five treatment groups were significantly different (probability <0.05). After grazing 1 and 2 weeks on sprayed forage, residues were 14.99 and 32.85 p/m, respectively; then, as expected, mean residues decreased in lambs grazing 6, 10, and 14 weeks on sprayed forage.

Residue in fat decreased rapidly in groups 1, 2, and 6 after removal to the unsprayed allotment (fig. 1), but only mean residues in groups 1 and 2 dropped significantly (probability <0.025) below the 5-p/m tolerance level--both after 8 weeks on unsprayed forage. Decline in residues in groups 10 and 14 was slower, and no means went below 5 p/m.

Differences in rates of loss among groups resulted from a variety of causes operating at different times. Early loss of DDT residue from forage through rainwash, bacterial action, volatilization, and dilution (fast forage growth) would decrease DDT ingestion. Through the season, lambs gained in weight from approximately 70 to 113 pounds with a greater degree of fatness in later samples, suggesting more dilution of DDT ingested. Also, the variation in decrease and increase noted in the isomers and metabolites during the course of the study would affect loss rates.

This paper is concerned with the marketability of lambs; and the rates of loss will be more fully

Table 1.--*Mean and confidence interval (95-percent probability) of DDT residues in kidney fat of sheep grazing 1 to 14 weeks on a DDT-sprayed allotment and subsequently on an unsprayed allotment. 1974 Douglas-fir Tussock Moth Project*[1/]

Number of weeks grazing	Treatment group					
	Control	1	2	6	10	14
	p/m DDT					
On DDT-sprayed allotment:						
1 (July 3)		14.99 (48.18-4.66)				
2 (July 10)			32.85 (70.13-15.39)			
6 (Aug. 6)				26.03 (29.72-22.81)		
10 (Sept. 5)					14.20 (22.01-9.16)	
14 (Oct. 2)						26.88 (38.00-19.02)
On unsprayed allotment:						
0	[2/] 0.046 (0.191-0.011)					
1	0.035 (0.066-0.018)	9.46 (24.22-3.70)				17.65 (27.06-11.52)
2	0.053 (0.118-0.024)		7.91 (8.21-7.61)		23.19 (45.34-11.87)	19.30 (31.74-11.74)
3		3.53 (5.64-2.21)		11.10 (34.24-3.60)		
4			2.58 (11.44-0.58)	8.56 (15.09-4.86)	12.00 (21.67-6.65)	
6	0.067 (0.161-0.028)				19.28 (178.52-2.08)	15.92 (26.25-9.65)
8		0.84 (1.22-0.57)	3.04 (4.26-2.17)	5.54 (7.22-4.26)		
10	0.100 (0.156-0.064)			6.51 (9.85-4.30)	9.16 (18.12-4.63)	10.59 (20.77-5.40)
14	*0.096 (0.134-0.069)	0.93 (2.52-0.35)	2.02 (3.90-1.04)	4.42 (10.46-1.86)	7.54 (14.36-3.96)	9.52 (14.89-6.09)
18			1.10 (2.22-0.54)	*3.36 (118.72-0.10)	*5.97 (10.38-3.44)	
19		0.85 (1.38-0.52)				
22			*1.58 (22.74-0.11)			

[1/] Values are means of 3-lamb samples except for 2-lamb samples shown with an asterisk (*) and are the sum of DDE, DDD, o,p' DDT, and p,p' DDT. The lower level of detectability is 0.010 p/m. Means and confidence intervals were derived from a logarithmic transformation of the residue values.

[2/] Control sample taken at beginning of study.

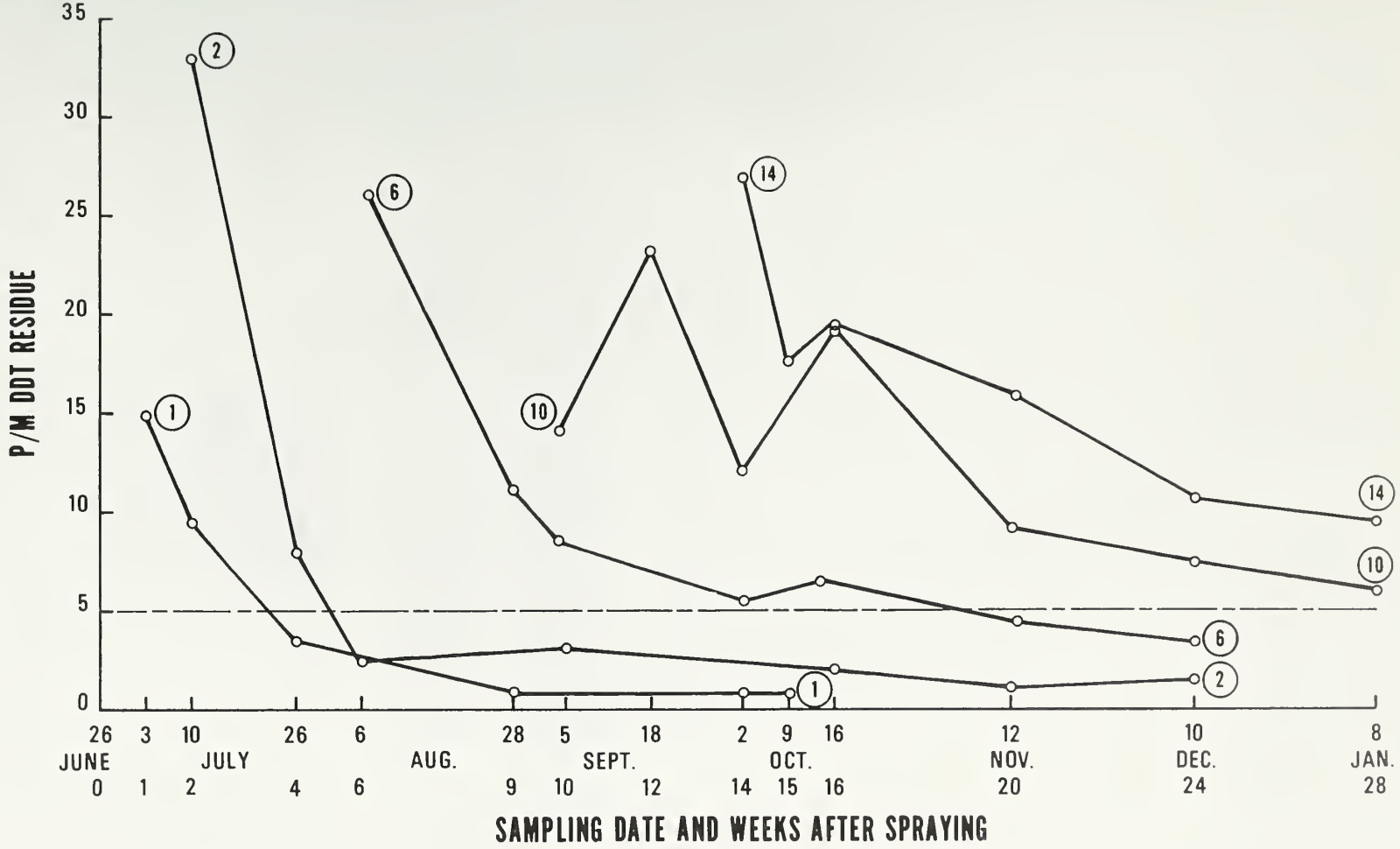

Figure 1.--*Decline of DDT residues in kidney fat of sheep after grazing 1, 2, 6, 10, and 14 weeks on DDT-sprayed forested range.*

covered following further analyses of DDT residues in vegetation, rumen, and fecal material. Under the conditions of this study, only the lambs grazing 2 weeks or less on the DDT-sprayed allotment were marketable--the group 1 lambs after August 28 and the group 2 lambs after September 5. Establishing a lower risk (probability <0.01) of saying the average level is below 5 p/m if it really isn't would not change the date for the group 1 lambs but group 2 lambs would not be marketable until after November 12.

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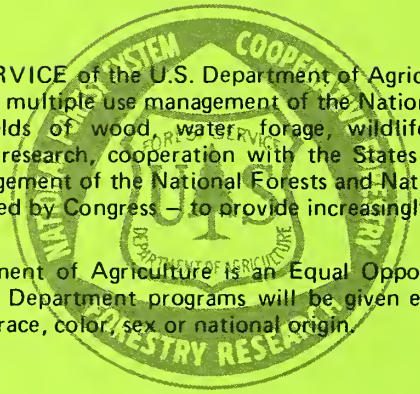

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